by means of a gas light placed behind it, and you will immediately see that the magical effects become more intense. It develops by degrees and produces nearly all the forms and images which are on the back, quite perfectly. You observe that the great quantity of small figures which are in but slight relief are not visible, while all the others of pronounced relief are clearly brought out. This fact is an important one. It shows us that we must look for magic mirrors only among those having ornaments in decided relief upon their backs. You must also know that they are not to be found among very thick mirrors. The experiment is still more successful with this Japanese toilet mirror.

The first experiments, after reading M. Govi's papers, were made by M. Ayrton and myself, as we desired to verify the investigation of the Italian *savant* before publishing them, and at the same time study thoroughly this very interesting subject, hoping that we might be able, perhaps, to reproduce the mirror in France instead of importing them from the extreme East. You must bear in mind that we had but one mirror at our disposition and that one but slightly magic. It belonged to M. Dybowski. We began by heating it as I shall show you presently. Here is the natural mirror which is hardly magical at all. You see the effect is produced in proportion to the amount of heat employed. Heat applied to several other Japanese mirrors bought in Paris or borrowed from collectors produced a magical effect upon them all.

These experiments were repeated by us very often. But it was not long before we discovered the inconveniences of the heating method. First of all, as it is extremely difficult to preserve an equal degree of warmth upon the entire surface. The image is rarely perfectly regular; then the mirror itself is somewhat altered. The reverse becomes covered with a bronze iridescence while the surface loses its polish because the heat destroys the amalgam which covers it, the mirror loaned to me was in a frightful condition when I returned it,but it was finally put in order again. The spots upon the back were removed by a coating of slightly acidulated water, and the amalgamation replaced by nickel plating which made a more perfect and durable polish. Before giving it back to its owner, however, we had numerous copies made from it, and it was one of these which I showed you a few moments since.

The disadvantages of heating made us wonder if the same effect could not be produced by a different method, and we thought of pressure. M. Duboscq solved the problem by means of this box. You see it is not thick, and is of the precise diameter of the mirror which is attached to the upper part by an iron ring and one of India rubber. The under portion is closed and provided with a spout and plug which it connects with the little hand pump well known as the Gay-Lussac. This pump inhales on one side, and exhales on the other. If we attach an India rubber tube to the spout, on the exhaling side the movement of the piston will compress the air behind the mirror. We will now try it.

The mirror becomes more convex and the image widens. The thin portions protrude more than the others and the magical effect grows more and more pronounced. It will be quite complete when the pressure attains two atmospheres. We have it now! You see, the effect is perfect. It is certainly much finer than anything M. Ayrton has shown us, although his experiments astonished us so much.

We can also produce an inverse effect, by attaching the rubber tube to the inhaling spout. The action of the pump will remove the air beneath the mirror, which will become less convex and you see the luminous disk contract. The thin portions corresponding to the outlines of the design will yield more than the others, become less convex and perhaps concave. They will reflect more light and we may see a new image appear which will be the exact reverse of the preceding. That is to say, that the parts in relief will appear black upon a white ground. This is a *negative* form of the first, in which we saw the relief traced in white upon a black surface.

M. Deboscq made many other experiments, one of which I will relate to you before I conclude.

I wished to go still further. I wished to have a cast taken of the mirror while it is magic, and make a galvano-plastic deposit in the mould so that we might have a magic surface instead of a mirror. We tried this three times. The plaster moulding was very successful and the surface magic, but the galvano-plastic deposit was a complete failure. If any one here among my audience can give me any advice upon the subject I would be most grateful.

Gentlemen, I hope sincerely I have been able to interest you in this new subject of magic mirrors. If I have succeeded in making my meaning throughout, clear to you, these mirrors will no longer be a mystery, and you will have seen once more how Science, by slow but sure efforts, is finally able to explain and reproduce phenomena, which at first sight seemed miracles, always provided that the phenomena are real and not mere phantoms of human credulity.

RECENT SURGICAL CASE.

The following case, which, in some respects, is similar to that of President Garfield's, may be read with interest for the purpose of comparison. The man was sent to St. Michael's Hospital, Newark, N. J., where his case was considered hopeless at the date of his entry. We are indebted to Dr. H. C. H. Herold for a copy of the following report:

George Freund, age 36, Germany, ex-policeman.—Admitted to hospital July 4th, suffering from bullet wound of chest. The wound was produced by a 22-inch calibre pistol, and situated an inch and three-quarters below and half an inch to the left of the left nipple. When seen half an hour after admission his pulse, temperature and respiration were all normal. On examining his lungs the percussion note was normal. On auscultation, rales were heard over both lungs, resulting from chronic bronchitis. He is subject to attacks of asthma. Heart sounds normal. Ordered one-quarter of a grain of morphine every two hours until sleep was obtained.

July 5.—Morning. Passed a very restless night, not seeming to feel the effects of the morphine. Temperature, 102; pulse, 120; respiration, 32, and very labored. It was ascertained on examination that he was suffering from an asthmatic attack. He has had no spitting of blood and no sign of any lung trouble. Ordered grains x of iodide of potash, three times a day. July 5.—Evening. Complains of great pain in the vicinity of the wound, extending toward the stomach. Temperature, 102; skin feeling to the hand cold and covered with a clammy sweat. Pulse, 80; quite feeble and compressible, intermitting at every second beat. Respiration, 30; not labored, having recovered from his asthmatic attack.

July 6.—Passed a very restless night; one-eighth grain of morphia given every two hours; temperature, 103; pulse, 110; respiration, 40; labored and sighing; slight hemorrhage from wound; all pain left him.

July 7.—Passed a quiet night, sleeping very well; only one-eighth grain of morphia administered; temperature, 101; pulse, 106; respiration, 18; slight hemorrhage from wound; expectoration of a sputa which looks very much like laudable pus.

July 8.—Slept quite well, taking one-eighth grain of morphia; complains of some pain in vicinity of wound; hemorrhage from wound ceased; has taken no food since admission, being sustained by stimulants, beef tea, milk, etc.; temperature, 102; pulse, 115, quite strong, intermitting at every fifth beat; respiration, 26.

July 9.—Very comfortable night, taking only one-

eighth grain of morphia; wound discharging laudable pus; temperature, 101½; pulse, 110; respiration, 24.

July 10.—Restless night, no morphia being given. Wound still discharging healthy pus. Temperature, 101½; pulse, 110; respiration, 26.

July 11.—Temperature, 101; pulse, 110; respiration, 24.

July 12.—Temperature, 102; pulse, 110; respiration, 22. Ordered digitalis.

July 13.—Temperature, 100½; pulse, 100; respiration, 22. Urine containing traces of albumen. Solid food taken and retained.

July 14.—Temperature, 101; pulse, 108; respiration, 20.

July 15.—Temperature, 100½; pulse, 95; respiration, 22.

July 16.—Temperature, 100½; pulse, 100; respiration, 22.

July 17.—Temperature, 101; pulse, 100; respiration, 23.

July 18.—Temperature, 101; pulse, 100; respiration, 22.

July 19.—Very restless night. Temperature, 101½; pulse, 130; respiration, 34. Complains of pain in the region of the heart.

July 20.— Temperature 101½; pulse, 120; respiration, 34.

July 21.—Temperature, 101; pulse, 112; respiration, 32.

July 23.—Restless night, troubled much by a short, hacking cough; wound entirely healed, Temperature, 100¾; pulse, 106; respiration, 32. Vomited his breakfast.

July 24.—Passed a restless night notwithstanding the free use of bromide. Temperature, 103; pulse, 130; respiration, 38. Still troubled with cough, which distresses him greatly; cannot retain solid food. Stimulants freely given.

July 25.—Slept better, but cough still troubles him; breathing labored. Temperature, 100¾; pulse, 65; respiration, 39; muscular twitching of hands and feet.

July 26.—Much more comfortable this morning. Temperature, 100½; pulse, 92; respiration, 40; digitalis discontinued.

July 27.—Temperature, 99; pulse, 58; respiration. 36.

July 28.—Temperature, 98½; pulse, 56; respiration, 30.

July 29.—Temperature, 99; pulse. 60; respiration. 32.

July 30.—Delirious during the night, attempted to get out of bed. Temperature, 99½; pulse, 52; strong and full; respiration, 28.

July 31.—Temperature 99½; pulse, 68; respiration, 32. Delirious during night. Bromides given freely.

August 1.—Temperature, 100; pulse, 52; strong and full; respiration, 34.

August 2.—Temperature, 98½; pulse, 51; respiration. 30. Delirious during night.

August 3.—Temperature, 98½; pulse, 108; respiration, 22. Troubled very much with attacks of coughing.

August 4.—Temperature, 98½; pulse, 100; respiration, 24.

August 5.—Temperature, 98½; pulse, 96; respiration, 24.

August 6.—Temperature, 100; pulse, 96; respiration, 20.

August 7.—Temperature, 99; pulse 94; respiration 19.

August 8—Temperature, 98¾; pulse, 88; respiration, 22; sleeps well; appetite, good.

August 9.—Temperature, 98½; pulse, 90; respiration, 20.

August 13.—Temperature, pulse and respiration have remained the same as on August 9. The patient for the first time to-day since his injury has been allowed to get up and dress.

August 18.—Doing well since last report. Walks around the wards; eats and sleeps well, the bullet remaining in his body.

ON THE GERM THEORY.*

By Prof. Pasteur.

"The subject of my communication is vaccination in relation to chicken cholera and splenic fever, and a statement of the method by which we have arrived at these results—a method the fruitfulness of which inspires me with boundless anticipations. Before discussing the question of splenic fever vaccine, which is the most important, permit me to recall the results of my investigations of chicken cholera. It is through this inquiry that new and highly important principles have been introduced into science concerning the virus or contagious quality of transmissible diseases. More than once in what I am about to say I shall employ the expression virus-culture, as formerly, in my investigations on fermentation, I used the expressions, the culture of milk ferment, the culture of the butyric vibrion, etc. Let us take, then, a fowl which is about to die of chicken cholera, and let us dip the end of a delicate glass rod in the blood of the fowl with the usual precautions, upon which I need not here dwell. Let us then touch with this charged point some *bouillon de poule*, very clear, but first of all rendered sterile under a temperature of about 115° centigrade, and under conditions in which neither the outer air nor the vases employed can introduce exterior germs—those germs which are in the air, or on the surface of all objects. In a short time, if the little culture vase is placed in a temperature of 25° to 35°, you will see the liquid become turbid and full of tiny microbes, shaped like the figure 8, but often so small that under a high magnifying power they appear like points. Take from this vase a drop as small as you please, no more than can be carried on the point of a glass rod as sharp as a needle, and touch with this point a fresh quantity of sterilized *bouillon de poule* placed in a second vase, and the same phenomenon is produced. You deal in the same way with a third culture vase, with a fourth, and so on to a hundred, or even a thousand, and invariably within a few hours the culture liquid becomes turbid and filled with the same minute organisms.

"At the end of two or three days' exposure to a temperature of about 30° C. the thickness of the liquid disappears, and a sediment is formed at the bottom of the vase. This signifies that the development of the minute organism has ceased—in other words, all the little points which caused the turbid appearance of the liquid have fallen to the bottom of the vase, and things will remain in this condition for a longer or shorter time, for months even, without even the liquid or the deposit undergoing any visible modification, inasmuch as we have taken care to exclude the germs of the atmosphere. A little stopper of cotton sifts the air which enters or issues from the vase through changes of temperature. Let us take one of our series of culture preparations—the hundredth or the thousandth, for instance—and compare it in respect to its virulence with the blood of a fowl which has died of cholera; in other words, let us inoculate under the skin ten fowls, for instance, each separately with a tiny drop of infectious blood, and ten others with a similar quantity of the liquid in which the deposit has first been shaken up. Strange to say, the latter ten fowls will die as quickly and with the same symptoms as the former ten; the blood of all will be found to contain after death the same minute infectious organisms. This equality, so to speak, in the virulence both of the culture preparation and of the blood is due to an apparently futile circumstance. I have made a hundred culture preparations—at least, I have understood that this was done—without leaving any considerable interval between

* "International Medical Congress." London, 1881.